

CLAIMS

1. A process for producing a self-disrupting filter cake in an underground formation, which process comprises:
  - 5 (a) incorporating into a drilling fluid a solid polymer capable of being converted by hydrolysis into one or more organic acids wherein the drilling fluid does not contain an acid-soluble bridging agent;
  - (b) using the drilling fluid to drill a wellbore into the underground formation such that the solid polymer in the drilling fluid contributes to the formation of a filter cake; and
  - 10 (c) allowing the solid polymer to hydrolyse in the presence of water and to disrupt the integrity of the filter cake.
2. A process according to claim 1 wherein the solid polymer is a polyester.  
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3. A process according to claim 1 or 2 wherein the solid polymer is an aliphatic polyester.
4. A process according to any one of the preceding claims wherein the solid polymer is a polymer which incorporates lactide, glycolide or caprolactone.  
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5. A process according to any one of the preceding claims wherein the solid polymer is a polymer which incorporates lactide, glycolide or caprolactone with other monomers.  
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6. A process according to the preceding claims wherein the solid polymer is polylactide, polyglycolide, lactide-glycolide copolymer, lactide-caprolactone copolymer, glycolide-caprolactone copolymer or lactide-glycolide-caprolactone copolymer.  
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7. A process according to any one of the preceding claims wherein the solid polymer is a polymer which produces one or more organic acids on hydrolysis.

8. A process according to any one of the preceding claims wherein the solid polymer is a polymer which produces lactic acid or glycolic acid on hydrolysis.

9. A process according to any one of the preceding claims wherein the solid polymer is a homopolymer or copolymer produced by the condensation of one or both of lactic acid and glycolic acid.

10. A process according to any one of the preceding claims wherein the solid polymer is in the form of a sphere, cylinder, cuboid, fibre, powder or bead, or other configuration.

11. A process according to any one of the preceding claims wherein the acid produced by hydrolysis of the polymer dissolves acid soluble material present in the filter cake or adjacent formation.

15 12. A process according to claim 11 wherein the acid soluble material is carbonate bridging material, carbonate formation fines, carbonate formation rock or scale or calcium sulphate.

20 13. A process according to any one of the preceding claims wherein the drilling fluid comprises the solid polymer in an amount of from 1 to 25% v/v.

14. A process according to any one of the preceding claims wherein the drilling fluid further comprises a polymer breaker

25 15. A process according to any one of the preceding claims wherein the solid polymer further comprises a polymer breaker.

16. A process according to any one of the preceding claims wherein the process  
30 further comprises displacing the drilling fluid with a fluid comprising a polymer breaker.

17. A process according to any one of claims 14 to 16 wherein the polymer breaker is a hydrolase enzyme.

18. A process according to any one of claims 14 to 17 wherein the polymer breaker is a polysaccharide hydrolysing enzyme.

19. A process according to any one of claims 14 to 18 wherein the polymer breaker is an enzyme which can hydrolyse starch, xanthan, cellulose, guar, scleroglucan or succinoglycan or a derivative of any one of these polymers.

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20. A process according to any one of claims 14 to 16 wherein the polymer breaker is an oxidant.

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21. A process according to claim 20 wherein the polymer breaker is an oxidant selected from persulphate, hypochlorite, peroxide, perborate, percarbonate, perphosphate, persilicate, metal cation and hydrogen peroxide adduct.

22. A process according to any one of claims 14 to 21 wherein the polymer breaker is in the form of a delayed release preparation.

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23. A process according to any one of claims 14 to 22 wherein the or each polymer breaker is incorporated into the polymer by encapsulation, to allow its or their controlled release coincident with or after acid production.

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24. A process according to any one of claims 14 to 23 wherein the or each polymer breaker is incorporated into the polymer by dissolution or dispersion to allow its or their controlled release coincident with acid production.

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25. A process according to any of the preceding claims wherein the solid polymer or drilling fluid and consequent filter cake further comprises calcium peroxide and wherein acid produced by hydrolysis of the solid polymer leads to the generation of hydrogen peroxide.

26. A process according to any of the preceding claims wherein the solid polymer, drilling fluid or solids free fluid further comprises ammonium bifluoride and wherein acid produced by hydrolysis of the solid polymer leads to the generation of hydrogen fluoride.

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27. A process according to any of the preceding claims wherein the drilling fluid further comprises calcium sulphate as a bridging agent.

28. A process according to any one of claims 14 to 27 wherein the polymer  
10 breaker is present in an amount sufficient to further disrupt the integrity of the filter cake.

29. A process according to any one of the preceding claims wherein the underground formation contains hydrocarbon or water.

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30. A process according to claim 29 wherein the underground formation contains hydrocarbon and wherein the process further comprises recovering a hydrocarbon from the treated formation.

20 31. A process according to claim 30 wherein the underground formation contains hydrocarbon and wherein the process further comprises recovering a hydrocarbon from the treated formation.

25 32. A process according to any one of the preceding claims wherein the solid polymer further comprises one or more other materials incorporated into the solid polymer by dissolution dispersion or encapsulation.

33. A process according to Claim 32 wherein the one or more other materials are selected from polymer breakers, specific gravity adjusting materials, calcium peroxide and ammonium bifluoride.  
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34. A drilling fluid suitable for drilling into an underground formation which contains as a bridging agent one or more solid polymers capable of being converted by hydrolysis into one or more organic acids. A drilling fluid suitable for drilling into an underground formation which contains as a bridging agent one or more solid polymers 5 capable of being converted by hydrolysis into one or more organic acids, wherein the drilling fluid does not contain an acid-soluble bridging agent
35. A drilling fluid according to claim 34 wherein the polymer is a polyester.
- 10 36. A drilling fluid according to claim 34 or 35 wherein the or each solid polymer is as defined in any one of claims 3 to 9.
- 15 37. A drilling fluid according to any one of claims 34 to 36 wherein the polymer hydrolyses in the presence of water and disrupts a filter cake incorporating the solid polymer.
38. A drilling fluid according to claim 37 wherein acid produced by hydrolysis of the polymer further disrupts a filter cake by reacting with acid soluble material present in the filter cake or adjacent formation.
- 20 39. A drilling fluid according to claim 38 wherein the acid soluble material is carbonate bridging material, carbonate formation fines, carbonate formation rock or scale or calcium sulphate.